TECHNICAL SPECIFICATION FOR HEAT SHRINKABLE TYPE, TAPE X TYPE, PRE MOULDED TYPE AND COLD SHRINKABLE TYPE JOINTING KITS AND TERMINATIONS

1.0 This specification covers the design, manufacture, testing and supply and Heat Shrinkable type, Premoulded type, Cold shrinkable type, Tapex type, Jointing and termination kits suitable for XLPE and PILC Cables manufactured in general conformity to the standards published by Bureau of Indian Standards, New Delhi.

1.1 The purchaser reserves the right to place orders for any type of terminations/joints.

2.0 The tenderers shall furnish in the tender the type and complete technical details of joints/terminations offered with dimensional drawings, materials, literature, type test certifications from recognized test houses/institutions failing which the offers are liable to the rejected.

3.0 The tenderers should furnish details of similar kits supplied to Electricity Boards and Electricity Utilities and performance certifications for a minimum period of three years.

4.0 The cable jointing kits/terminations are required for use on PILC/XLPE Cables, the details of which are as noted below:

1.	Type	:	PILC/XLPE insulated conductor and insulation screened.
2.	Voltage	:	11KV
3.	Conductor	:	Circular Compacted Aluminium
4.	No. of Cores & Cross Sectional area of conductor	:	Three Core – 95, 240 and 400 Sq.mm. Single Core – 1000 Sq.mm.
5.	Armour	:	G.I. Round/Formed, Wire/Hard drawn, Aluminium wire.
6.	Sheath	:	a) Lead alloy E. Sheathed in Case of PILC Cable. b) PVC Compound type ST-2 in case of XLPE Cable.
7.	Installations	:	Directly buried in ground. .

5.0 **HEAT SHRINKABLE TYPE**:

5.1 The term 'Heat Shrinkable' refers to extruded or moulded – polymeric material which are cross linked to develop elastic memory and supplied in an expanded or otherwise deformed size and shape. Subsequent heating in an unconstrained state to a temperature above the shrink temperature results in the materials recovering or shrinking to its original shape.

5.2 Stress control and stress grading wherever necessary in the termination and joint shall be by means of semi conducting heat shrinkable tubing.

5.3 Environmental sealing between the heat shrinkable materials and cable surfaces shall be achieved by using hot melted sealants or adhesives. Where such sealants or adhesives are exposed to high electrical stress, they must be track resistant. The adhesive or sealant used in the joint/terminations should not permit any entry of moisture into the joint/termination.

5.4 The external covering of insulated cores for terminations shall be by means of modified silicon heat shrinkable tubing's, which have non tracking and erosion resistant properties. The purchaser reserves the right to insist on checking the tracking resistance property of the non tracking materials.

6.0 **PREMOULDED TYPE (XLPE CABLE)**:

6.1 The term permoulded refers to of pre manufactured work-tested parts of a termination or joint of moulded Ethylene Propylene Diane Monomer (i.e. EPDM) rubber or silicone Rubber components with non tracking and erosion resistant properties.

6.2 The stress control and stress grading components/material wherever necessary in the terminations and joints shall be highly track resistant insulating section vulcanized to a semi conducting section.

6.3 Interface between the premoulded stress control/grading – component screen material and cable surface shall be achieved by semi conducting material which has cold flow properties. The design should climinate voids/air packets at the interface and discharge at the cable screen edges.

6.4 The stress cone must be of proven design for stress control. The semi conducting portion of ht stress cone should be vulcanized with insulation so that both semi conducting and insulation portion becomes an integrated part.

6.5 Environment sealing and to prevent ingress of moisture – between premoulded components and cable surface/end shall be provided with compatible component/device.

7.0 **TRANSITION JOINTS**:

In this specification the transition joint is defined as a straight through cable joint between two cables of different designs. The construction of the two cables to be joined, differ in insulation material, water barriers and configuration of cores, and stress distribution.

The transition joint is intended to be used between two cable 11 KV Grade, 3 core of following description.

1. Paper insulated, Mind, Lead Covered, Double steel tape/round wire armoured of either belted or screened design. The conductor is Aluminium with stranded sector shape or stranded circular shape.

2. Cross linked polyethylene insulated cables of screened type with formed wire or round wire Armour, with PVC jacket. The conductor is Aluminium circular, compacted, generally the sizes of the conductor are 95, 240 and 400 Sq.mm.

7.1 **Design Requirements**:

The joint must be capable of meeting the performance requirements of both the PILC and XLPE cables. The design must ensure that any interaction between the jointing – materials and the cable materials are not detrimental to either the performance of the transition joint or the cables to be joined.

i) STRESS CONTROL
The design of transition joint must control and limit high electrical stress and prevent discharges which occur at.

a) The termination (cut) of the lead sheath or earth envelop in a three core belated cable.

b) At the screen cut back in a screened cable.

c) In the area of conductor connection (Ferrule/connector).

ii) CONTENT OF PAPER IMPREGNANT
The design should ensure that there will be no contact between impregnant of the paper cable and the insulating and screening materials on the XLPE side of the joint. The transition joint must be capable of totally eliminating any

migration of the impregnant form the MI/MIND cable to XLPE cable.

iii) The transition joint must provide for continuation of armour/ earth continuity. The fault current carrying capacity of the earth/armour continuity must not be less than that provided on the cables being joined.

iv) The transition joint must be provided with a strong over-all cover for a protection to prevent ingress of moisture in to the joint.

8.0 **TAPEX TYPE SYSTEM**:

8.1 The term Tapex refers to the kits using self amalgamation/self vulcanizing insulation tape made of EPDM Rubber/EPR Tapes and Non linear stress grading material for stress control.

8.2 The stress control shall be by means of non liner resistance material.

8.3 The joints and terminations shall met the requirement of class 1 accuracy of IEEE-48.

8.4 The stress grading material shall be wrapped around the cable core, overlapping the edge of the outer conducting layer. The top layers shall fuse together to form a compact rubber body around the stress grading material and cable core thereby exert on active pressure on cable.

8.5 DESIGN REQUIREMENTS:

The joints and terminations shall provide the following performance function:

a) Electric Stress Control between the semi conducting screens and over the ferrule.

b) Reinstatement of cable insulation.

c) Environmental and moisture sealing.

d) Mechanical strength and protection.

e) The tapes shall be self amalgamating/self vulcanizing having Antitracking, Corona, Ozone and UV light resistant.

f) The joints and terminations shall not require penciling of insulation and preparation of semi conducting screen at right angles or evenly.

9.0 **REQUIREMENTS**:

The Heat Shrinkable Type/Premoulded Type/Tapex Type/Straight Through Joints, Transition Joints, Indoor and Outdoor Terminations shall be suitable for 11KV, XLPE and PILC Underground Cable of sizes.

a) 3 Core x 95 Sq.mm.
b) 3 Core x 240 Sq.mm.
c) 3 Core x 400 Sq.mm.
d) 1 Core x 1000 Sq.mm.

9.1 The approximate total requirement of jointing kits and terminations of various sizes are as per Annexure.

9.2 The quantity shown is only approximate and is subject to increase or decrease depending on the actual requirement.

10.0 **SERVICE CONDITIONS**:

10.1 The straight through joint transition joints shall be suitable for use with cables which are directly buried in ground.

10.2 The indoor terminations shall be suitable for use in switchgear designed for both Indoor and Outdoor installation.

10.3 The outdoor terminations shall be suitable for use in directly exposed atmospheric conditions.

11.0 **POWER SYSTEM PARTICULARS**:

1. System voltage	:	11 KV
2. Highest voltage	:	12 KV
3. Neutral	:	Effectively earthed
4. Frequency	:	50 HZ + OR – 3%
5. CSA of conductor	:	3 core 95 to 400 Sq.mm. Aluminium 1 core 1000 Sq.mm. Aluminium
6. Rated Current at 90^0C	:	3 Core 195 to 410 Amps 1 Core 740 Amps.

12.0 **CLIMATIC CONDITIONS**:

a. Site locations	:	Various sites in Karnataka State.
b. Altitude	:	Not exceeding 1000M above sea level.
c. Ambient Temp.	:	50^0C Max. 5^0C Min.
d. Relative Humidity	:	100% Max. 10% Min.
e. Rainfall	:	As per Indian Monsoon.

13.0 **STANDARDS**:

13.1 The testing of the completed system of joints and terminations shall be in accordance with the following standards, with latest amendments.

a) IS 13573: Joints and terminations of polymeric cables for working voltages from 6.6 KV upto & including 33 KV performance requirements and type tests.

b) VDE 0278 Power Cables accessories with rated voltage upto 30KV.

The other applicable standards for testing of accessories and material properties of document shall be:

i) IS 7098 Part (2) – 1985: Cross linked polyethylene insulated PVC sheathed cables.

ii) IEC 60502 – Extruded solid dielectric power cables for rated voltages from 1 KV upto 30 KV.

iii) ISI 0913 – Electricity supply industry (Electricity Technical Association) performance specification for high voltage heat shrinkable components for use with high voltage solid type cables Upto and including 33KV.

iv) IEEE 48 – Test procedures and requirements for high voltage alternating current cable terminations.

v) ISO-R 37 – determination of tensile stress strain properties of vulcanized rubbers.

vi) ASTM – D – 2303 liquid contaminant inclined plane tracking and erosion test.

vii) IEC 60243 recommended method of test for electric strength of solid insulating materials at power frequencies.

14.0 **DESIGN REQUIREMENTS**:

a) **Joints**: The joint shall provide for the following performance functions.

i) Electric stress control between the cable semi-conducting screens and over the ferrule.
ii) Reinstatement of cable insulation.
iii) Environmental protection and moisture sealing.
iv) Mechanical strength and protection.

b) **Terminations**: The terminations shall be designed to provide.

i) Electric stress control for the cable insulation shield terminus.

ii) Complete external leakage insulation between the cable conductor/conductors and earth.

iii) Seal to the end of the cable against the entrance of external environment.

c) The joints and terminations in the form of completed system shall meet the type test requirements as per the standards:

i) IS 13573 } with latest amendments
ii) VDE 0278 }

15.0 **TESTS**:

15.1 Routine Tests:

a) Visual inspection.
b) Dimensional check.
c) Physical verification of kit contents as per bill of material.

15.2 Acceptance Tests:

a) Tensile strength for tubings.
b) Ultimate elongation test for tubings.
c) Longitudinal shrinkage.

The above tests shall be conducted on samples selected at random from each lot of supply, at suppliers works or a reputed test house at suppliers costs.

15.3 **Type Test:**

The successful bidder shall arrange at his own cost for conducting of type test on a completed system, at a reputed test house. The samples for such tests will be selected at random by the purchaser out of supplies offered. The tests will be witnessed by the representative of the purchaser. The type tests to be conducted shall be as prescribed in IS 13573 – or equivalent standards.

16.0 **TEST CERTIFICATE**:

16.1 The material offered shall be fully type tested as per relevant standards and the tenderer shall furnish type test reports from CPRI, Bangalore or VDE test certificates from any National/International test house.

16.2 For any change in the design/type already type tested and the design/ type offered against this specification, the purchaser will draw a sample from the supplies and the type test on these will be carried out by the supplier at his cost. In case the material/system fails in the type test the entire lot will be rejected.

16.3 The purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative.

17.0 **DRAWINGS**:

The tenderer shall furnish the dimensional drawing of the joints and terminations offered.

18.0 **GUARANTEED TECHNICAL PARTICULARS**:

The guaranteed technical particulars of the joints/terminations offered shall be furnished by the tenderer.

19.0 **TESTING FACILITY**:

The bidder shall furnish the details of manufacturing and testing facilities available with him and the address of their test houses where manufacturing and testing will be carried out.

20.0 **INSPECT AND TESTING**:

20.1 In respect of components like tubings, mouldings and sealants the bidder shall furnish the proof of source of supply, manufacture test reports and quality assurance reports along with the bid, against past supplies similar documents shall be made available in respect of this order during inspection s and testing.

20.2 The supplier shall tender necessary assistance in inspection and for witnessing of testing at his work/test house.

21.0 **QUALITY ASSURANCE**:

The bidder shall invariably furnish the following information along with the offer. The information shall be separately given for individual components of the system offered, failing which the offer will be rejected.

i) Statement giving list of important components, auxiliaries, source of supply of raw materials, list of standards according to which the materials are tested, list of tests carried out on materials, test reports under type approval and quality assurance.

ii) List of areas in manufacturing process where stage inspections are normally carried out from quality control and details of such tests and inspections.

iii) The quality assurance plan with hold points for owners inspection. The quality assurance plan and owners hold points shall be discussed between the owner and contractor before the QAP is finalized

iv) The supplier shall furnish the routine test certificates of bought out accessories and central excise gate pass for imported items during inspection.

22.0 **DEVIATION**:

Any deviation from the specifications shall be setout clause by clause by the tenderer in a separate sheet titled “Technical Deviations”.

23.0 **BILL OF MATERIALS/KIT CONTENTS**:

23.1 Each jointing/termination kit supplied as a single kit shall be self sufficient and contain all necessary electrical/mechanical components for making a complete joint/termination. There shall be absolutely no necessity of any additional material/component, except the contents supplied in the kit for making the joint/termination. Terminal lugs shall be of copper only.

23.2 The bid shall accompany with detailed list of kit contents/bill of materials, describing the component, quantity, material of component, dimensions size, weights lengths of tubings etc.

23.3 All the kit contents shall have unlimited life for storage in Indian conditions.

23.4 Any components which has a specific shelf life, the component should be stamped with date of manufacturing and the expiry date.

24.0 **PACKING AND MARKING**:

24.1 All components pertaining to a joint or termination shall be packed in a strong separate cardboard carton with each component sealed and labeled.

24.2 The package shall be marked with the name of the manufacturer, supplier, type designation, and relevant technical information along with address of consignee the details of consignment batch No., bill of materials for each package.

25.0 **LIST OF DOCUMENTS TO BE FURNISHED WITH THE BID**:

25.1 (i) Technical Brochure
(ii) Drawings
(iii) Installation Instructions
(iv) Type test reports on complete (joint and termination) system and the components
(v) Quality assurance plan
(vi) Supply record, clearly indicating the address of the purchaser, order reference, material supplied, voltage class, quantity and date of supply.
(vii) Test report literature, brochure of bought out items.
(viii) Performance reports/certifications from customers.

26.0 **GUARANTEE**:

26.1 The jointing kits and terminations shall be guaranteed for satisfactory and trouble free operation for a period of five years from the date of supply against defects in the materials or design.

26.2 In case of failure within the guaranteed period due to faulty design and defective materials, and on such information to the supplier the jointing/termination kit will be replaced free of cost by the supplier within a period of 3 months from the date of intimation by the purchaser.

27.0 **TRAINING**:

The successful bidder shall arrange for training of purchaser's Engineers at any two places of choice in BESCOM. The kit will be supplied by the purchaser.

General Manager El.,
Procurement, BESCOM.